

What is claimed is :

1                   1. A method of accessing a data structure, the method comprising:  
2                   initializing a flux count associated with a data structure to an even value;  
3                   in response to a request to modify the data structure, sequentially and in order:  
4                   incrementing the flux count to an odd value;  
5                   acquiring an exclusive serialization mechanism for the data structure;  
6                   modifying the data structure;  
7                   releasing the exclusive serialization mechanism; and  
8                   incrementing the flux count to an even value; and  
9                   in response to a request to access data from the data structure, sequentially and  
10                  in order:  
11                  copying the flux count to obtain a copy of the flux count;  
12                  copying the requested data from the data structure to obtain a copy of the  
13                  requested data; and  
14                  determining that the copy of the requested data is valid if the copy of the  
15                  flux count is an even value and the copy of the flux count is still equal to the  
16                  flux count after the copy of the requested data is obtained.

1                   2. The method of claim 1, further comprising, in response to the request to access  
2                   data from the data structure determining that the copy of the requested data is not valid if  
3                   either the copy of the flux count is an odd value or the copy of the flux count is not equal  
4                   to the flux count after the copy of the requested data is obtained.

1                   3. The method of claim 2, further comprising, in response to determining that the  
2                   copy of the requested data is not valid, acquiring a shared serialization mechanism for the  
3                   data structure and obtaining a copy of the requested data while the shared serialization  
4                   mechanism is acquired.

1                   4. The method of claim 2, further comprising, in response to determining that the  
2 copy of the requested data is not valid, repeating the copying of the flux count and the  
3 copying of the requested data from the data structure until the copy of the flux count is an  
4 even value and the copy of the flux count is still equal to the flux count.

1           5. A method of accessing a data structure, the method comprising:

2           in connection with modifying the data structure:

3                 prior to modifying the data structure, updating a flux indicator associated  
4                 with the data structure from a first state to a second state to indicate that the  
5                 data structure is in the process of being modified; and

6                 after modifying the data structure, updating the flux indicator to a third state  
7                 to indicate that the data structure is no longer in the process of being modified,  
8                 wherein the third state is different from each of the first and second states; and  
9           in connection with accessing data from the data structure:

10                 obtaining a first copy of the flux indicator in connection with obtaining a  
11                 copy of data from the data structure;

12                 obtaining a second copy of the flux indicator after obtaining the copy of the  
13                 data from the data structure; and

14                 determining that the copy of the data from the data structure is valid if the  
15                 first copy of the flux indicator does not indicate that the data structure is in the  
16                 progress of being modified and if the first and second copies of the flux  
17                 indicator have the same state.

1           6. The method of claim 5, wherein the flux indicator includes a count value  
2           capable of being set to a value selected from a set of values to indicate that the data  
3           structure is not in the progress of being modified, wherein the first state of the flux  
4           indicator includes a first count value in the set of values, wherein updating the flux  
5           indicator to the third state includes updating the count value to a second value in the set  
6           of values that is different from the first value, and wherein determining that the copy of  
7           the data from the data structure is valid includes determining if the count values for the  
8           first and second copies of the flux indicator are equal.

1           7. The method of claim 6, wherein the count value is further capable of being set  
2           to a value selected from a second set of values to indicate that the data structure is in the

3 progress of being modified, wherein the second state of the flux indicator includes a first  
4 count value in the second set of values, and wherein determining that the copy of the data  
5 from the data structure is valid includes determining if the count value is set to a value  
6 from the second set of values.

1 8. The method of claim 7, wherein the first set of values comprises even numbers,  
2 and wherein the second set of values comprises odd numbers.

1 9. The method of claim 6, wherein the flux indicator further includes an in flux  
2 flag, wherein updating the flux indicator from the first state to the second state includes  
3 setting the in flux flag, wherein updating the flux indicator to the third state includes  
4 resetting the in flux flag, and wherein determining that the copy of the data from the data  
5 structure is valid includes determining if the in flux flag for the first copy of the flux  
6 indicator is set.

1 10. The method of claim 6, wherein the first set of values is selected from the  
2 group consisting of a monotonic sequence, a prime number sequence, and a Fibonacci  
3 sequence.

1 11. The method of claim 5, wherein updating the flux indicator to the third state  
2 includes storing a current clock value.

1 12. The method of claim 5, wherein updating the flux indicator to the third state  
2 includes storing a random value.

1 13. The method of claim 5, wherein the flux indicator includes a count value,  
2 wherein the first state of the flux indicator includes an even count value, wherein  
3 updating the flux indicator from the first state to the second state includes incrementing  
4 the flux indicator to an odd count value, wherein updating the flux indicator to the third

5 state includes incrementing the flux indicator to an even count value, and wherein  
6 determining that the copy of the data from the data structure is valid includes determining  
7 if the count values for the first and second copies of the flux indicator are equal and  
8 determining if the first copy of the flux indicator is set to an even count value.

1 14. The method of claim 5, wherein accessing the data from the data structure is  
2 performed without acquiring a serialization mechanism.

1 15. The method of claim 5, wherein accessing the data from the data structure  
2 further comprises accessing the data from the data structure after acquiring a shared  
3 serialization mechanism in response to determining that the copy of the data from the data  
4 structure is not valid.

1 16. The method of claim 5, wherein accessing the data from the data structure  
2 further comprises determining that the copy of the data from the data structure is not  
3 valid, and in response thereto, repeatedly obtaining of the first copy of the flux indicator,  
4 obtaining the copy of data from the data structure, and obtaining the second copy of the  
5 flux indicator until the first copy of the flux indicator does not indicate that the data  
6 structure is in the progress of being modified and the first and second copies of the flux  
7 indicator have the same state.

1 17. The method of claim 5, wherein the data from the data structure includes a  
2 plurality of fields, wherein obtaining the first copy of the flux indicator in connection  
3 with obtaining the copy of the data from the data structure includes obtaining the first  
4 copy of the flux indicator in connection with obtaining copies of the plurality of fields,  
5 and wherein determining that the copy of the data from the data structure is valid includes  
6 determining that the copies of the plurality of fields are valid based upon the flux  
7 indicator.

1           18. The method of claim 5, wherein modifying the data structure further includes,  
2           after updating the flux indicator from the first state to the second state and before  
3           updating the flux indicator to the third state, acquiring an exclusive serialization  
4           mechanism for the data structure, thereafter modifying the data structure, a thereafter  
5           releasing the exclusive serialization mechanism.

1           19. The method of claim 5, wherein the data structure comprises a journaled  
2           object, and wherein the data in the data structure includes an indication of whether the  
3           journaled object is in a standby mode.

1           20. An apparatus, comprising:

2               a memory and at least one processor;

3               a data structure resident in the memory;

4               a flux indicator associated with the data structure;

5               first program code configured to execute on the at least one processor to modify  
6               the data structure, the first program code configured to, prior to modifying the  
7               data structure, update the flux indicator from a first state to a second state to  
8               indicate that the data structure is in the process of being modified, and, after  
9               modifying the data structure, update the flux indicator to a third state to indicate  
10              that the data structure is no longer in the process of being modified, wherein the  
11              third state is different from each of the first and second states; and

12              second program code configured to execute on the at least one processor to  
13              access data from the data structure, the second program code configured to obtain  
14              a first copy of the flux indicator in connection with obtaining a copy of data from  
15              the data structure, obtain a second copy of the flux indicator after obtaining the  
16              copy of the data from the data structure, and determine that the copy of the data  
17              from the data structure is valid if the first copy of the flux indicator does not  
18              indicate that the data structure is in the progress of being modified and if the first  
19              and second copies of the flux indicator have the same state.

1           21. The apparatus of claim 20, wherein the flux indicator includes a count value  
2           capable of being set to a value selected from a set of values to indicate that the data  
3           structure is not in the progress of being modified, wherein the first state of the flux  
4           indicator includes a first count value in the set of values, wherein the first program code  
5           is configured to update the flux indicator to the third state by updating the count value to  
6           a second value in the set of values that is different from the first value, and wherein the  
7           second program code is configured to determine that the copy of the data from the data  
8           structure is valid by determining if the count values for the first and second copies of the  
9           flux indicator are equal.

1           22. The apparatus of claim 21, wherein the count value is further capable of being  
2 set to a value selected from a second set of values to indicate that the data structure is in  
3 the progress of being modified, wherein the second state of the flux indicator includes a  
4 first count value in the second set of values, and wherein the second program code is  
5 configured to determine that the copy of the data from the data structure is valid by  
6 determining if the count value is set to a value from the second set of values.

1           23. The apparatus of claim 22, wherein the flux indicator further includes an in  
2 flux flag, wherein the first program code is configured to update the flux indicator from  
3 the first state to the second state by setting the in flux flag, wherein the first program code  
4 is configured to update the flux indicator to the third state by resetting the in flux flag,  
5 and wherein the second program code is configured to determine that the copy of the data  
6 from the data structure is valid by determining if the in flux flag for the first copy of the  
7 flux indicator is set.

1           24. The apparatus of claim 20, wherein the flux indicator includes a count value,  
2 wherein the first state of the flux indicator includes an even count value, wherein the first  
3 program code is configured to update the flux indicator from the first state to the second  
4 state by incrementing the flux indicator to an odd count value, wherein the first program  
5 code is configured to update the flux indicator to the third state by incrementing the flux  
6 indicator to an even count value, and wherein the second program code is configured to  
7 determine that the copy of the data from the data structure is valid by determining if the  
8 count values for the first and second copies of the flux indicator are equal and  
9 determining if the first copy of the flux indicator is set to an even count value.

1           25. The apparatus of claim 20, wherein the second program code is configured to  
2 access the data from the data structure without acquiring a serialization mechanism.



1           26. The apparatus of claim 20, wherein the second program code is configured to  
2 access the data from the data structure by accessing the data from the data structure after  
3 acquiring a shared serialization mechanism in response to determining that the copy of  
4 the data from the data structure is not valid.

1           27. The apparatus of claim 20, wherein the second program code is configured to  
2 access the data from the data structure by determining that the copy of the data from the  
3 data structure is not valid, and in response thereto, repeatedly obtaining of the first copy  
4 of the flux indicator, obtaining the copy of data from the data structure, and obtaining the  
5 second copy of the flux indicator until the first copy of the flux indicator does not indicate  
6 that the data structure is in the progress of being modified and the first and second copies  
7 of the flux indicator have the same state.

1           28. The apparatus of claim 20, wherein the data from the data structure includes a  
2 plurality of fields, wherein the second program code is configured to obtain the first copy  
3 of the flux indicator in connection with obtaining the copy of the data from the data  
4 structure by obtaining the first copy of the flux indicator in connection with obtaining  
5 copies of the plurality of fields, and wherein the second program code is configured to  
6 determine that the copy of the data from the data structure is valid by determining that the  
7 copies of the plurality of fields are valid based upon the flux indicator.

1           29. The apparatus of claim 20, wherein the first program code is configured to  
2 modify the data structure by, after updating the flux indicator from the first state to the  
3 second state and before updating the flux indicator to the third state, acquiring an  
4 exclusive serialization mechanism for the data structure, thereafter modifying the data  
5 structure, a thereafter releasing the exclusive serialization mechanism.

1                   30. The apparatus of claim 20, wherein the data structure comprises a journaled  
2                   object, and wherein the data in the data structure includes an indication of whether the  
3                   journaled object is in a standby mode.

1           31. A program product, comprising:

2               first program code configured to modify a data structure, the first program code  
3               configured to, prior to modifying the data structure, update a flux indicator  
4               associated with the data structure from a first state to a second state to indicate  
5               that the data structure is in the process of being modified, and, after modifying the  
6               data structure, update the flux indicator to a third state to indicate that the data  
7               structure is no longer in the process of being modified, wherein the third state is  
8               different from each of the first and second states;

9               second program code configured to access data from the data structure, the  
10              second program code configured to obtain a first copy of the flux indicator in  
11              connection with obtaining a copy of data from the data structure, obtain a second  
12              copy of the flux indicator after obtaining the copy of the data from the data  
13              structure, and determine that the copy of the data from the data structure is valid if  
14              the first copy of the flux indicator does not indicate that the data structure is in the  
15              progress of being modified and if the first and second copies of the flux indicator  
16              have the same state; and

17              a signal bearing medium bearing the first and second program code.

1           32. The program product of claim 31, wherein the signal bearing medium  
2           includes at least one of a recordable medium and a transmission medium.